Viskit Discrete Event Simulation Development Tool and the Simkit Model Repository

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Overview

- Introduction
- Event Graph Methodology
- Simkit Java Implementation
- XML Schema for Event Graph Representation
- Viskit, Visual Tool for Event Graph Construction
- Model Repository

Introduction

Barriers to use of simulation models

- Simulation = “Big and Costly”
- Time to develop model
- Lack of rigorous methodology
- Lack of rapid-development tools

Introduction (cont)

Breaking the Barriers

- Event Graph Methodology
- Simkit Programming API
- Viskit Graphical Tool
- XML Schema for Component Representations

Tools to Build Tools to build Models

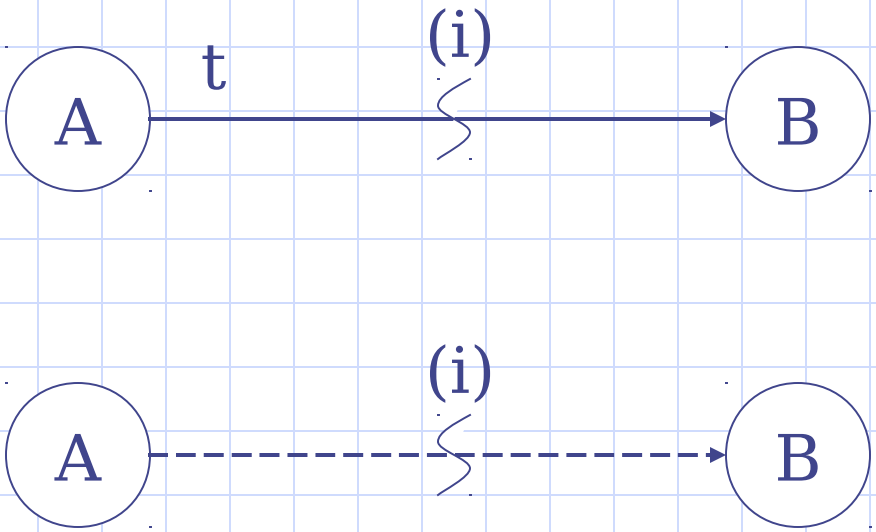
Event Graph Methodology

"Pure" Discrete Event Simulation (DES)

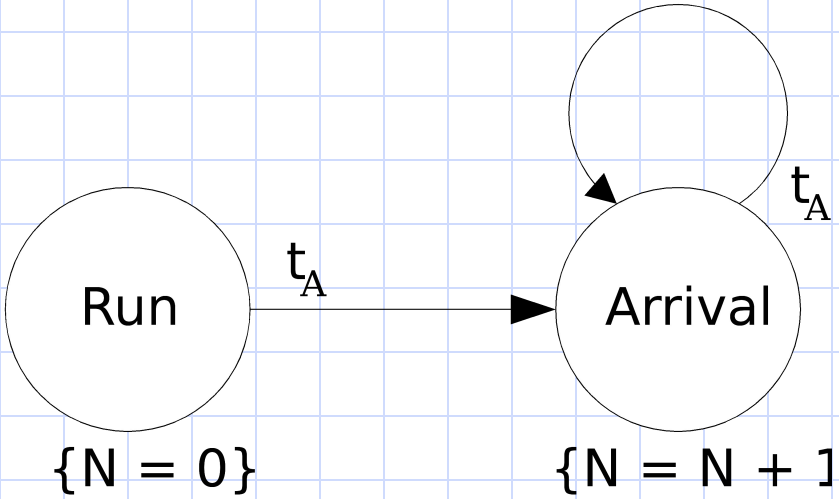
Four Elements to DES Model

- Parameters
- State Variables
- Events (State Transition Functions)
- Scheduling Relationships Between Events

Event Graph Methodology (Schruben 1983)



Simple Event Graph



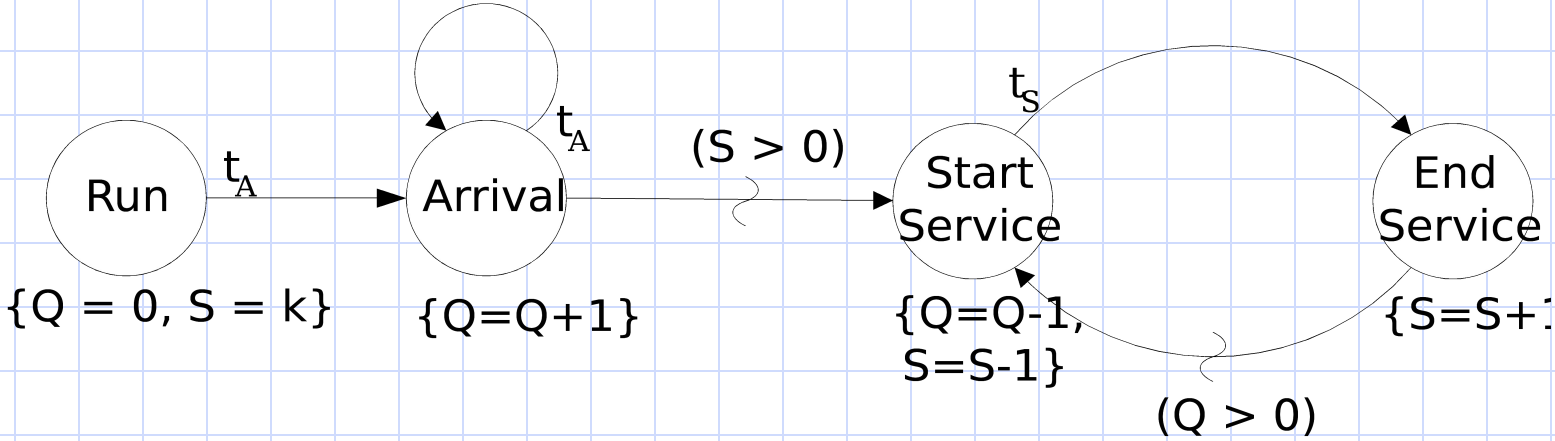
Parameter

- **$\{t_A\}$ = interarrival tim**

State Variable

- **N = # arrivals**

More Complicated Event Graph

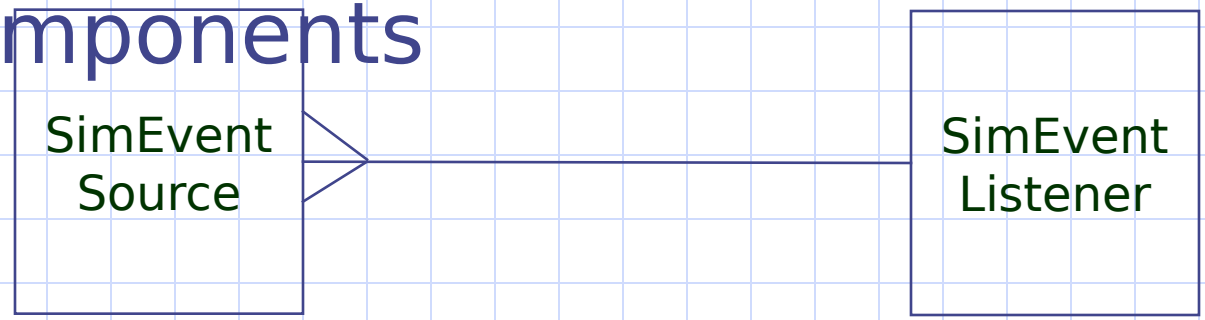


Event Graph Components

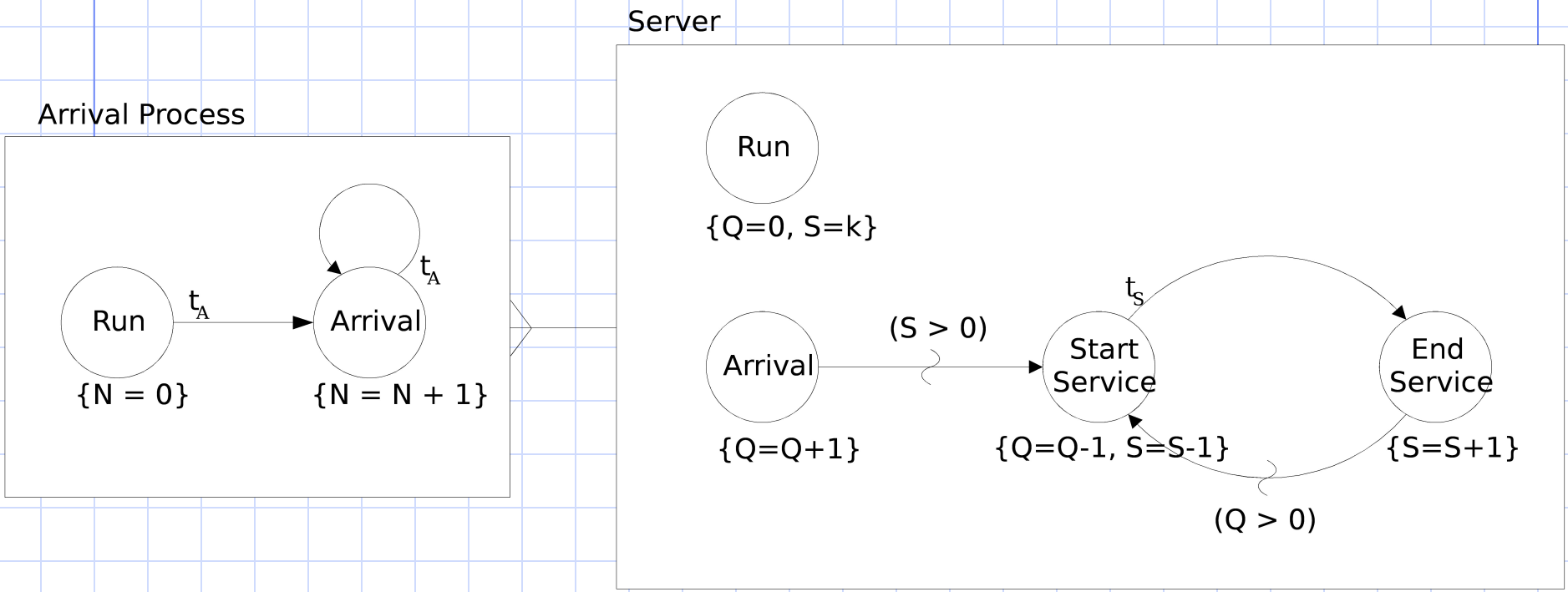
- Based on “Listener” Pattern
- Loosely Coupled Simulation Components
- Listener Event Graph Objects (LEGO)

SimEventListener Pattern

- SimEvent Source dispatches its SimEvent to registered SimEvent Listeners
- All SimEvents (except “Run”) are “heard” by Listener
- Used for assembling models from components



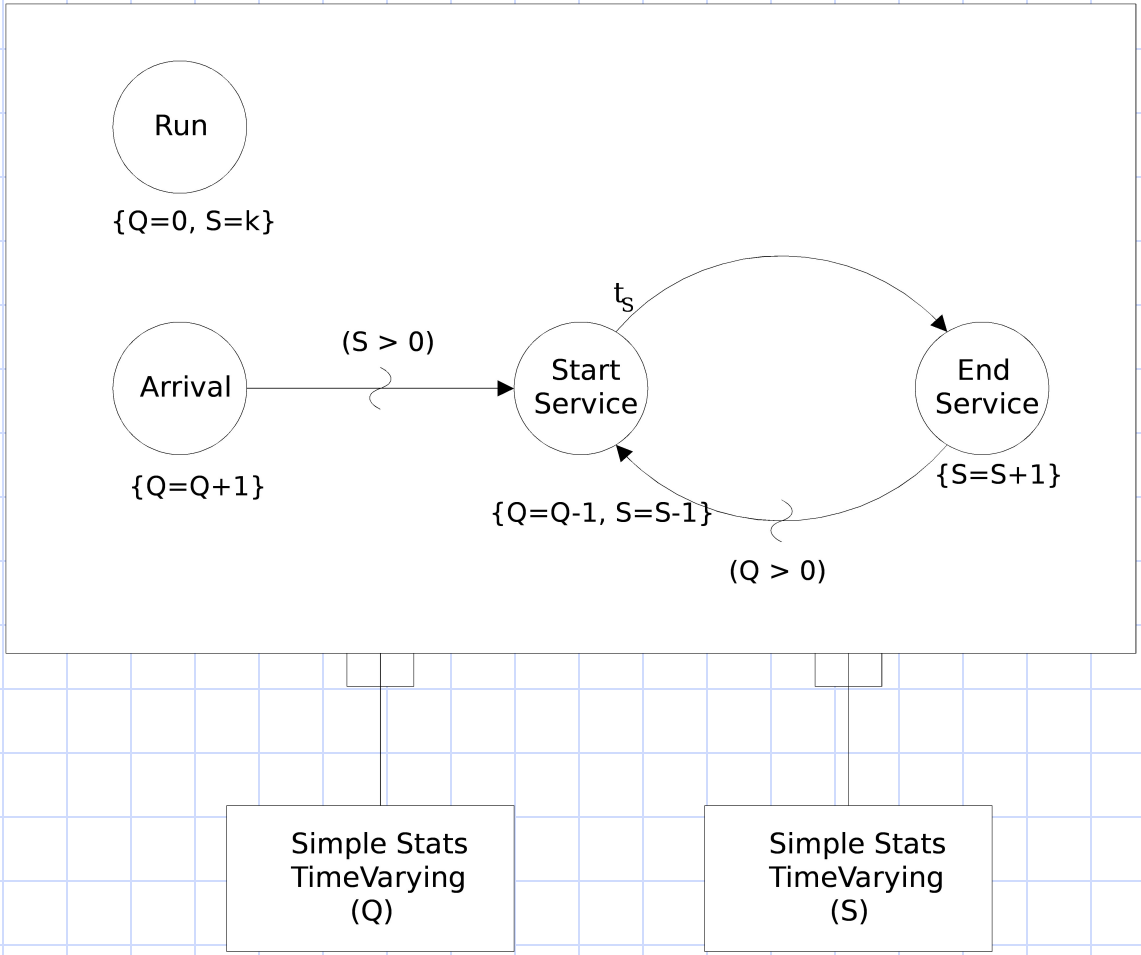
Example: Multiple Server Queue



Property Change Listener Pattern

- PropertyChangeEvents fired at every state transition
- Listener may register for specific or all PropertyChange Events
- Used for statistics, graphing, etc.

Property Change Listener Example



Simkit

- Java API for creating Event Graph models
- Open Source
- Effective for teaching DES
- Used in more than 30 NPS Masters Theses
- Implements Listener Event Graph Object pattern

Simkit

- Based on solid Event Graph methodology
- Enables reasonably rapid construction of DES models
- NPS OR/MV students able to implement models in matter of a few months
- Enabler for implementing new features in DES models

Recent NPS Theses using Simkit

- REMUS vehicle for mine detection (Allen, 2004)
- Repair and Sparing of Jet Engines (Schoch, 2003)
- Operational Availability of MMA (Margolis, 2003)
- Submarine Mine avoidance (Nawara, 2003)
- Dynamic Allocation of Fires and Sensors (Havens, 2002)

Viskit Motivation

- Simkit requires Java programming
- Need for non-programmer use
- Need for rapid development tool
- Organize reusable components
- Repository of existing models and components for reuse

XML for Event Graph Components

- Data-centric representation of Event Graph Components
- XML is standard, open data format
- Language and Implementation independent
- Enabler for web services

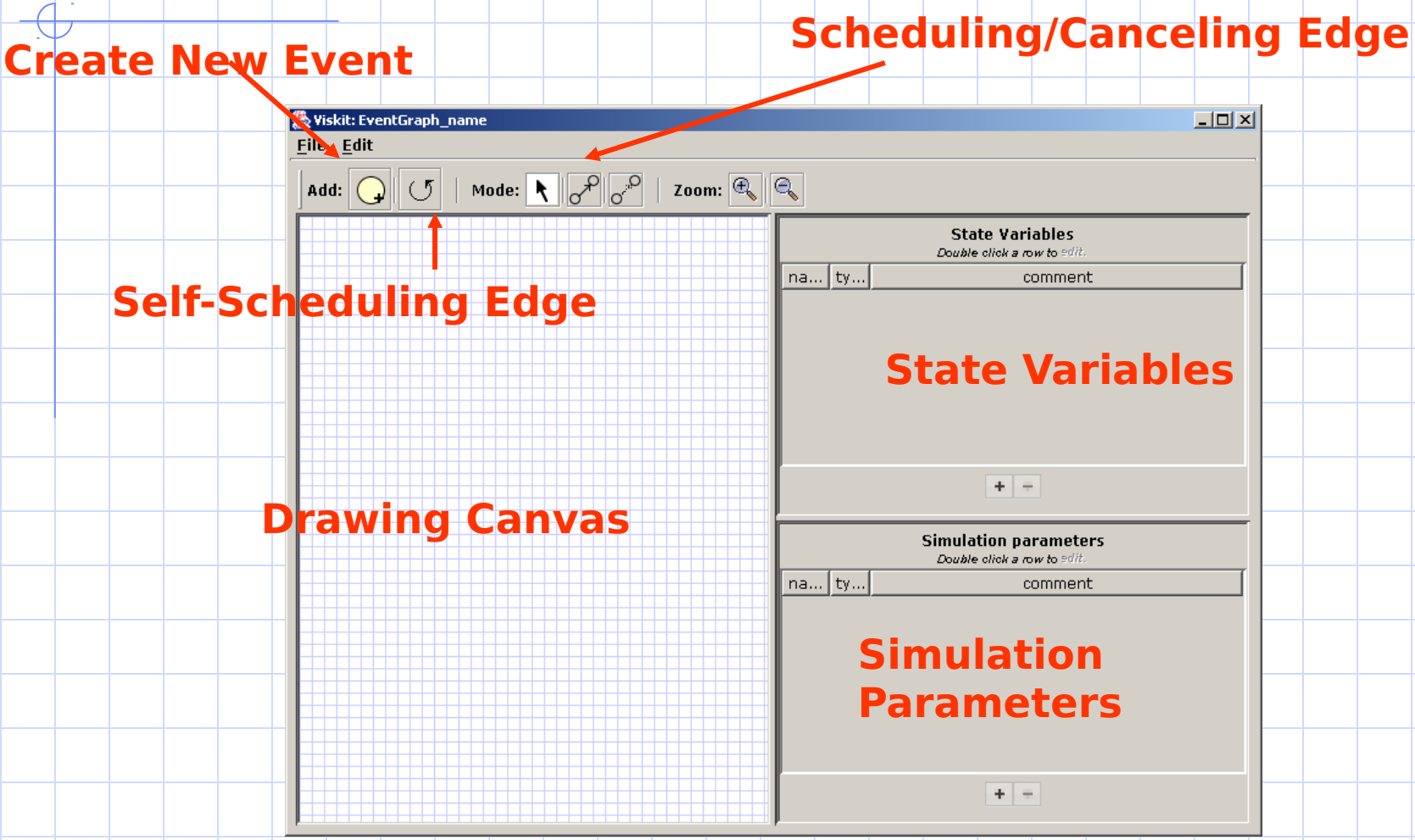
Code Generator

- Generates Simkit Java code from XML document
- SimEntity XML document -> SimEntityBase subclass
- Assembly XML document -> instances of SimEntities and Listeners

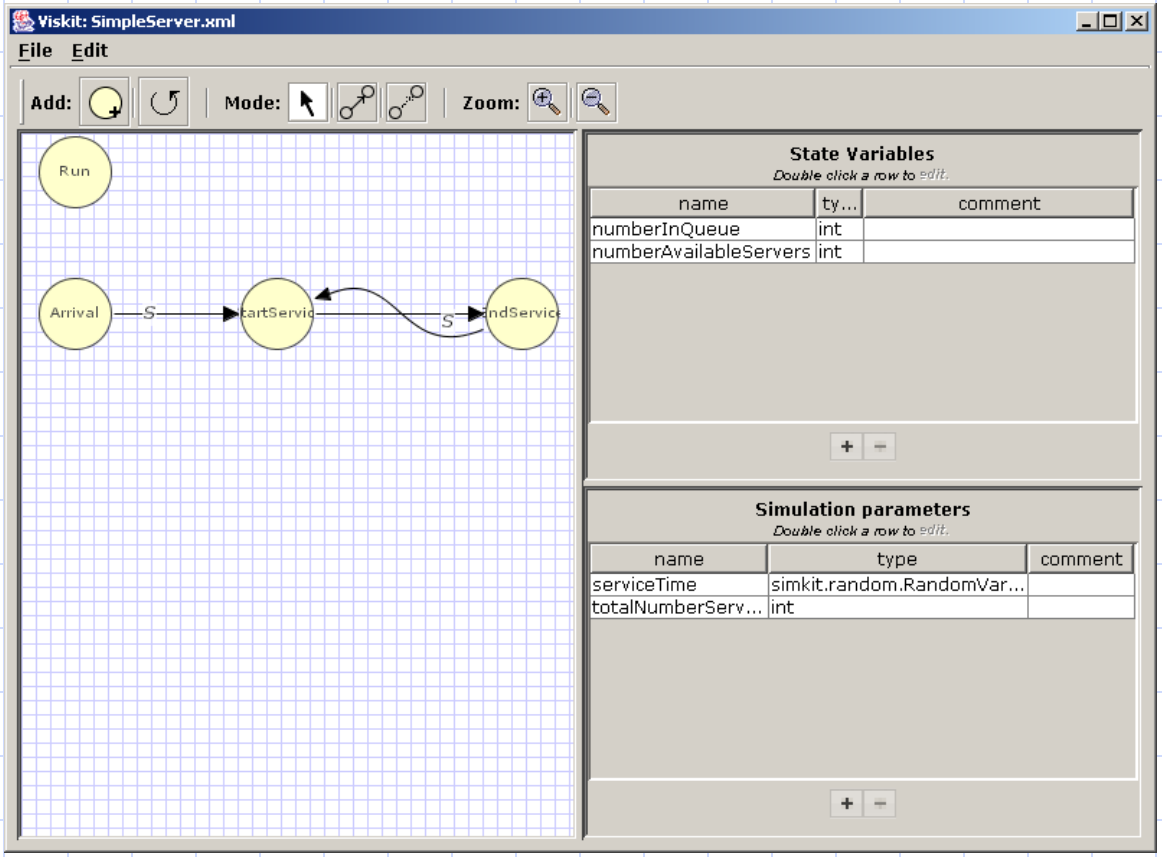
Viskit Event Graph Editor

- Even more rapid development of Event Graph Components
- Exposes Event Graph structure better than code
- Modeler draws Event Graph and fills in information
- Open Source

Viskit Event Graph Editor



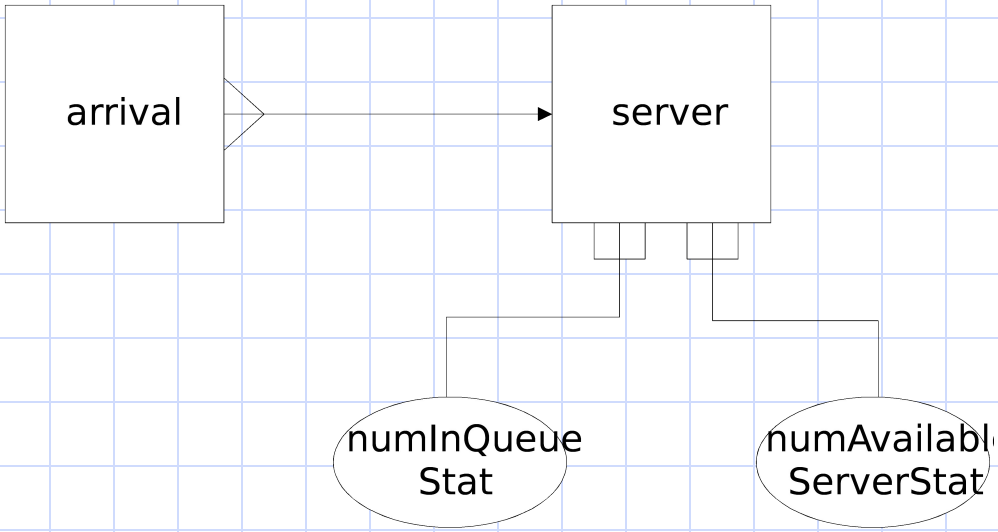
Server Component in Viskit



Viskit Assembly Editor

"Assembly" consists of

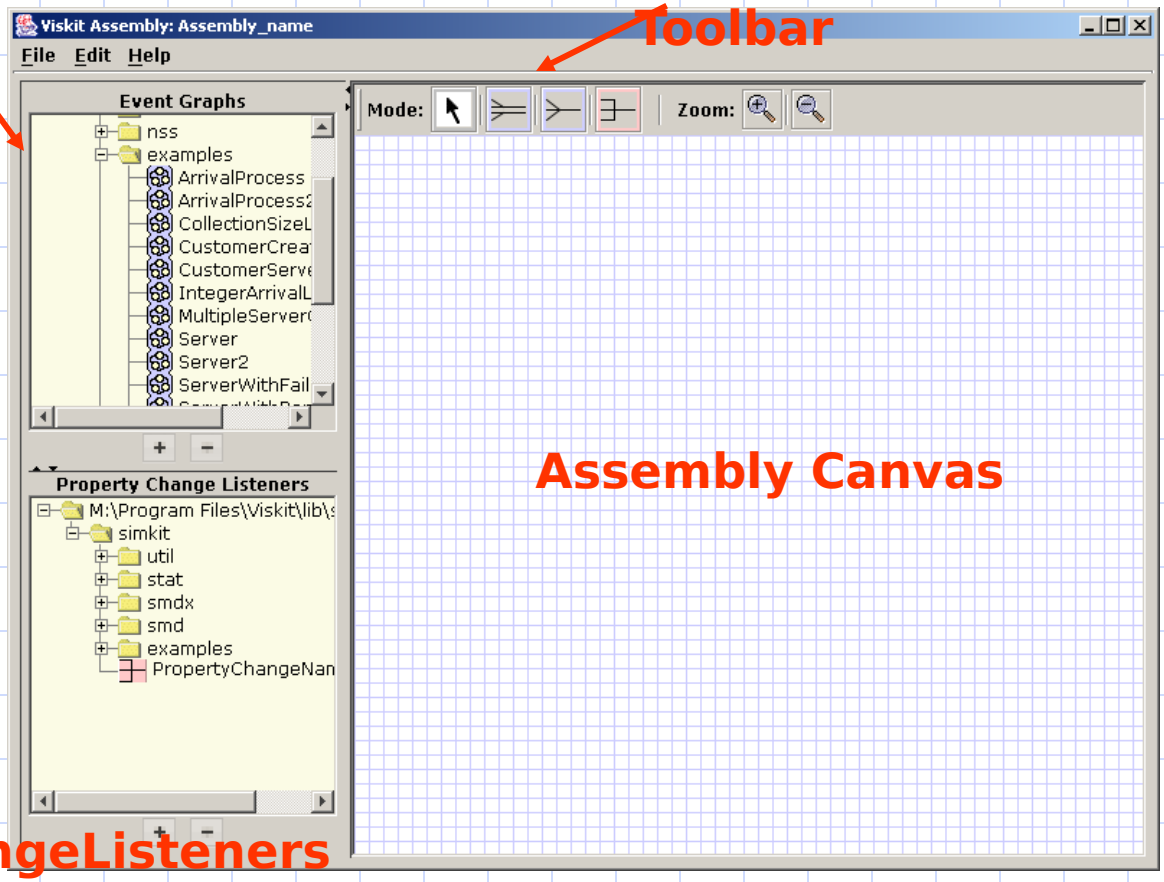
- Instances of SimEntities and PropertyChangeListeners
- Listening connections



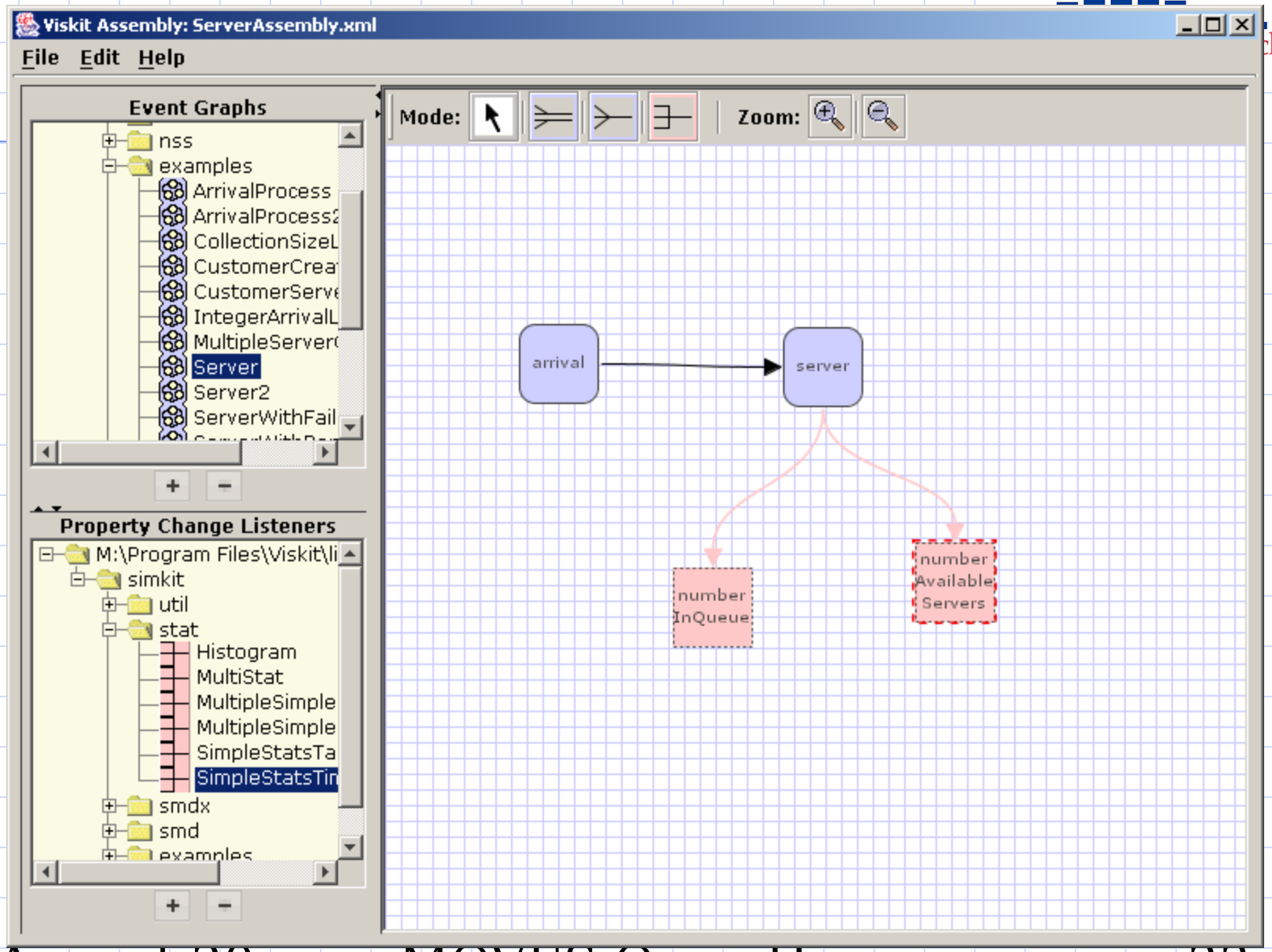
Viskit Assembly Editor

Event Graph Components

Listener Connection Toolbar



PropertyChangeListeners


Viskit Assembly: ServerAssembly.xml
File Edit Help
Event Graphs
nss
examples
ArrivalProcess
ArrivalProcess2
CollectionSizeL
CustomerCrea
CustomerServe
IntegerArrivalL
MultipleServer
Server
Server2
ServerWithFail
Property Change Listeners
M:\Program Files\Viskit\li
simkit
util
stat
Histogram
MultiStat
MultipleSimple
MultipleSimple
SimpleStatsTa
SimpleStatsTi
smdx
smd
examples
Mode:
Zoom:
arrival
server
number InQueue
number Available Servers

Simkit Model Repository

- Many student thesis models in Simkit
- Create repository of these models
- Older models require upgrade to current version (typically minor)
- Execution from common interface

Selection of Topics

- Control of REMUS Underwater Vehicle (Allen, 2004)
- Mine Avoidance by Submarine (Nawara, 2004)
- Anti-Terrorist Protection (Childs, 2002)
- Repair and Sparing Of The F414-Ge-400 Jet Aircraft Engine (Schoch, 2003)
- Dynamic Allocation of Fire and Sensors (Havens, 2002)

Questions